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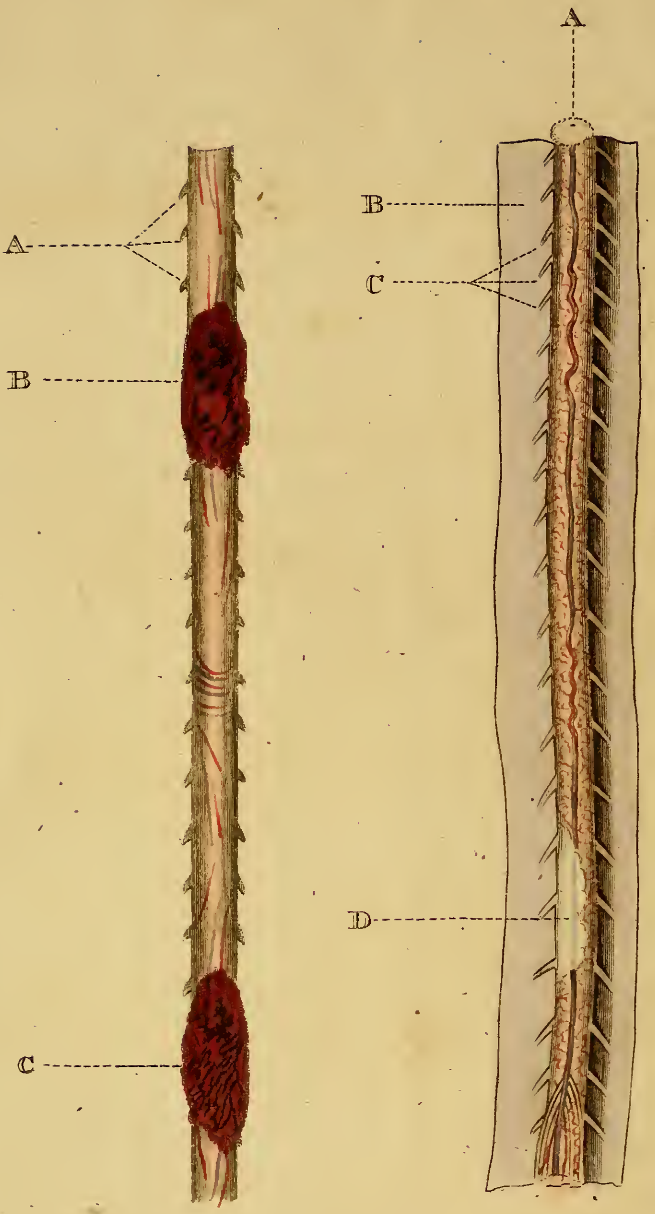

FIG. I FIG. II

MORBID APPEARANCES
of
the Spinal System in
Tetanus.

HOLBROOKE SCULPT ANGLESEA

ON THE

NATURE AND TREATMENT

OF

TETANUS & HYDROPHOBIA,

WITH SOME

OBSERVATIONS

CNB

ON A NATURAL CLASSIFICATION

OF

DISEASES IN GENERAL.

BY ROBERT REID, M. D.

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1817.

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To HUGH FERGUSON, M. D.

FELLOW OF THE KING'S AND QUEEN'S COLLEGE
OF PHYSICIANS,
AND PHYSICIAN TO THE RICHMOND LUNATIC ASYLUM.

SIR,

PERMIT me to dedicate the following Pages to you, as a trifling mark of respect and gratitude for the kind attentions you have shown me, from the very commencement of my Medical studies. Allow me to assure you, that the deep sense of obligation can never be effaced from

Sir,
Your most obedient,
Humble Servant,
ROBERT REID.

16, Belvedere Place,
March, 1817.

PREFACE.

The following Pages are laid before the Public, with a view of attracting the attention of Physicians to certain operations of the animal economy, which have not hitherto been taken into consideration, in the treatment of diseases. Several cases of Tetanus and Hydrophobia having lately occurred in this City, the Author has been induced to apply principles, which he has for a long time found satisfactory to himself, to the investigation of the nature and treatment of these terrible diseases.

It must be obvious, that to point out any new system, under which the great and varied operations of the Animal Frame may be considered, must be attended with considerable difficulty.—The view which is given of the principles of a natural classification of diseases in general, may appear not sufficiently explicit, as the trains of phenomena which have led to such general conclusions, are not given in detail. To have followed this subject through all the intricacies of the Animal economy, would have extended this Publication beyond the limits originally intended.

A classification of this kind, cannot give rise to any mischief, when applied to practice; but should it afford any useful hint, by which the suffering of even a single fellow-creature can be alleviated, the Author would feel full recompense for all his trouble.

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FIG. I.

A front view of the Spinal Marrow, covered with the dura mater.

(*a*) Where the nerves pass out to be distributed to the muscles.

(*b*) Extravasation into the cellular substance, between the dura mater and the bodies of the lower cervical and two upper dorsal vertebræ.

(*c*) A similar extravasation, situated at the bodies of the two superior lumbar vertebræ.

FIG. II.

A front view of the nervous substance of the Spine, covered only with the arachnoid coat and pia mater.

(*a*) The vein, and all the vessels appearing remarkably tortuous.

(*b*) The dura mater split up, and spread out.

(*c*) The nerves perforating it.

(*d*) A whitish substance thrown out between the arachnoid coat and pia mater.

ON
DISEASES
INCIDENTAL TO THE
SPINAL SYSTEM.

CHAP. I.

Of a natural Classification of Diseases in General.

BEFORE we enter into an investigation of the class of diseases incidental to the nervous system of the Spine, it is necessary we should take a general view of the principles upon which the classification is founded.

The animal body is constructed of a variety of organs, which are more or less numerous and complicated, according to the perfection of the individual. In man, and the higher orders of animals, we observe that the different organs are held in communication, by means of nervous systems, and from which they derive the proper stimulus to their activity.

When we inspect the anatomical structure of man, we observe the nerves distributed into three grand natural divisions. The first supplying the organic vicera of the Thorax and Abdomen, and which, from its peculiar formation, is properly called the Ganglionic System by anatomists.

The second is enclosed in the bony canal of the vertebral column, and may hence be denominated the Spinal System. This distributes its nerves to all the muscular parts of the body.

The third having its centre in the head, comes under the name of the Cerebral System; to this belong the intellectual powers and the five senses.

Comparative anatomy shews, that nature seems to adopt this division, throughout the various individuals of animated being; some are endowed with the first, and, of course, enjoy only the limited faculties, peculiar to that system, others have the second superadded; but man, of all other animals, possesses the three in the highest perfection.

Man thus including the three modifications of animated being, it is obvious that the operations of each system, must be regulated by the others, so as to keep up that balance of activity, which is comprehended under the term health.

From this complicated structure of the human frame, and from the immense variety of external circumstances, which influence the operations, carrying on in the living body, it is evident that without some arrangement of the Phenomena, the human mind could not form any accurate distinction between the salutary and morbid actions.

The salutary actions are therefore considered in that branch of the science of medicine, denominated Physiology, the knowledge of which has been of late so wonderfully increased.

In forming an arrangement of the mordid actions, there are two important objects to be constantly kept in view. The first is the formation of a title, under which all the previous experience of ages, relating to the subjects, can easily be laid down. The next is to make the title such, that the practitioner would be led to it, by fair examination of actual symptoms, while at the bedside of the patient.

By this means, medicine would obtain a scientific character, and the physician would act with that decision and promptitude, in the treatment of diseases, which is so often necessary in critical cases.

Disease is properly defined, that condition of the body, in which the actions of life and health, are not performed, or performed imperfectly, since however a disease is an effect, resulting from its cause, it must be considered as a particular entity, distinct from all others. It ought therefore to be accurately known or understood, according to its peculiar and individual nature, in order that it may be cured.

The symptoms of a disease, are a certain number of phenomena, which must be always present, and without which the disease is not. As however the essential symptoms often excite others, which at first appear more conspicuous than themselves, owing to the peculiarity of constitution, or circumstances of the patient: in actual practice, we are sometimes obliged to work upon them, and thus deduce the nature of the disease, like the unknown quantity in algebraical calculations.

Led by these considerations, while investigating the phenomena of disease, it is obvious that we ought to follow the path which nature points out. I would therefore propose to arrange diseases, under three general heads, which should be named according to the nervous system, in which each was principally seated.

One may be struck, at first, by the analogy which this division would seem to bear, to that distinction of the functions into the vital, the animal, and the natural. It would therefore appear necessary, to show the objections to that arrangement, and then to point out the difference between it and the one proposed.

It must be obvious that the terms are improper, as any function of the body must belong to life. The first term therefore must include the others. When we come to examine the comprehension of each, we at once observe the differences between the two arrangements. Thus, the vital functions, are those which cannot be interrupted, for even a short time, without danger to life, and include the action of the brain, nerves, the circulation of the blood, and respiration. This definition would therefore evidently extend to the three classes now proposed, and hence cannot be confined to any one. The animal functions include only voluntary motion—but in man, we find many muscular actions, performed without the immediate influence of the will—the natural functions being those of concoction, secretion, and excretion, relate only to a part of the Ganglionic System.

The defects of this arrangement seem, indeed, to have been felt by **Dr. Cullen**, as he could not make it applicable to the general classification of diseases, hence it is evident, that a distribution of diseases, according to the nervous sytems, in which they are principally seated, can bear no relation whatsoever, to the generally received arrangement of the functions.

One of the most important circumstances in favour of a classification of diseases, according to the principles before stated, is, that by this mode, we obtain a clearer view of the balance of activity, which is necessary to constitute health. This view may be confined to definite limits, when we observe, that although the balance may be deranged, in a particular organ, only, or even a part of an organ, of one system, yet when weighing it with regard to the others, the whole of the diseased system, must be taken into consideration.

Thus in acute disease of the liver, attended with symptomatic fever, we cannot consider the functions of the liver alone; but must take the whole of the Ganglionic Viscera, as opposed to the Cerebral. Experience shows, that this has long been tacidly agreed to, as the treatment, in these cases, is by no means confined to the liver, but extends to the Viscera belonging to the Ganglionic System in general.

By considering diseases, according to the nervous systems, to which they principally belong, we can account for phenomena, which have been observed to occur during morbid actions, from the earliest institution of medicine. Thus we meet with no disease that does not exhibit some phenomena, which seem to oppose the morbid symptoms essential to it. The ancients seem to have been well aware of this circumstance, and many of them laid down no other rule of practice, but what they said nature pointed out. But not being acquainted with the animal economy, and therefore incapable of judging accurately, which were the morbid actions, or which the salutary, their practice was generally inert, and often tended to increase the disease, that they proposed to have relieved. A most conspicuous proof of the latter circumstance, may be seen in the difference between the ancient mode of treating fever, and that adopted by the moderns; hence this disease, which was so generally fatal, in former times, is now, comparatively speaking, not dangerous.

The tendency of the animal economy to oppose morbid actions, has been taken notice of by Physicians, even to the present day, and has passed under various denominations, until it has ended in the term vis Medicatrix Naturæ. We know that all diseases must be cured by the vires Medicatrices Naturæ, as it is only by the powers of the system, which he is able to excite or repress, that a physician can oppose morbid actions, for it is evident that in the dead body there is no disease.

But it is obvious that this term only expresses a fact, without explaining its nature, hence that accurate observer **Dr. Cullen**, could form no definite idea of its meaning; but referred it to a general law of the animal economy, whereby it happens that powers, which have a tendency to hurt or destroy the system, often excite such motions, as are suited to obviate the effects of the noxious power. But so little was he acquainted with the source from whence this opposition to disease arose, that he says "altho the vis Medicatrix Naturæ "must unavoidably be received as a fact; "yet wherever it is admitted, it throws an obscurity on our system. And it is only where "the importance of our art is very manifest

" and considerable, that we ought to admit of
" it in practice."

When, however, we contemplate the operations of the different systems, which constitute the human frame, we will perceive that each system, is formed by nature, to perform certain functions in the animal economy. But they are so intimately connected with each other, when conspiring to support the animal body, as one whole and entire system, that the function of any one cannot be interrupted, without having some influence upon the rest. The effect of this influence then must be, to excite or repress the actions of the different organs. We will find, however, in the investigation of diseases, that the systems which are not immediately engaged in the morbid state, will take on actions, which are not only capable of resisting the effect of disease, upon themselves, but often prove salutary, by restoring the healthy balance of activity, throughtout the whole. This tendency then, is the long celebrated vis Medicatrix Naturæ, which we are enabled to point out with precision, and support or excite, during the treatment of diseases, by considering the operations of the animal frame, according to the natural classification, which is now proposed.

As we have before remarked, that in every disease, there can be observed both salutary and morbid actions. I will defer speaking any farther on these, until I come to treat of individual cases.

At first view, it may appear difficult to arrange the immense variety of diseases, to which the human frame is liable, under three such classes, as are now proposed. It is necessary therefore, to point out the distinguishing characters of each nervous system, while in health; but as this properly belongs to another place, a few general observations will be sufficient here.

If we could discover any property peculiar to a nervous system, which cannot be present where such nervous system is absent, and must therefore, be essential to its perfection, it is evident, that any disease, affecting that nervous system, must be indicated by a modification of that property. Hence then, to form any certain diagnosis of diseases, we must know what essential property of the nervous systems, is primarily and principally affected in each. When we consider that each system of nerves, is distributed to certain parts of the animal frame, and there performs an exclusive function, although the three systems are held in reciprocal communication. By pointing out, clearly, the function which each has to perform, in the healthy state, we will find little difficulty in appropriating a derangement of any part of those functions, to its proper class.

The Ganglionic system, being that discovered to be present in the first order of animals, which exhibits a nervous apparatus; it would naturally appear the first to claim our attention when investigating the nature of disease. It is indeed rendered almost necessary to understand the nature of diseases, in this system, before we could attend with advantage, to either of the superior systems. For although we find an established law in the animal economy, that each superior system, has the power of modifying the others, inferior to it. Thus the changes of the blood in the lungs, could not take place without muscular actions; yet the others could not perform their functions, without obtaining their support and nourishment from this. Phisiology shows the evidence of this, for we find the Ganglionic System is appropriated, by nature, to the formation of the various substances, which compose the animal body, and to remove those particles which have already performed their office. Any diseases therefore, primarily affecting these functions, must belong to the Ganglionic System.

Phisiology teaches us that the nerves originating in the spinal canal, are all directed to the muscular parts of the body. And that every part constituted of muscular substance, must derive its stimulus of activity from this system. In viewing the connexion, however, between this system and the Ganglionic, we observe a very important circumstance. It has been already shown that the latter is calculated for the formation of the different materials, of the animal frame; but when the Spinal System is superadded, this appears to regulate, entirely, the mode in which these substances are to be deposited. Thus we find that when a spinal nerve is divided, or included in a ligature, the parts to which it was distributed, first cease to grow, and then diminish in size, owing to absorption continuing after the deposition of new particles had been stopped. These phenomena occur although the sanguiferous circulation be unimpaired. Paralysis is a familiar example of this circumstance from disease.

Another important circumstance, is that no heat will be generated by the circulation of the blood through the part. This has been satisfactorily, proved by the experiments of Mr. Brodie, as related in the Philosophical transactions, of the Royal Society of London, having destroyed the functions of the nerves, by means of certain poisons, while the circulation of the blood was unimpaired, the temperature of the animals gradually diminished.

If then we should observe that the action of the muscles was impaired, while the circulation of the blood continued free, or that the muscular substance became diminished, while the powers of assimilation remained perfect, we should have little hesitation in attributing the disease, to the Spinal System. Examples of diseases, of this system, will be abundantly conspicuous when treating of Tetanus and Hydrophobia.

With respect to diseases of the cerebral system, it is obvious, from what has been said of the others, that any affection of the intellectual powers, and of the five senses, must belong to this, as we find that the nervous mass of the brain, is appropriated to these functions. As however, in man, and the superior animals, the substances necessary for the nourishment of the individual, must be chosen from the great variety of materials which surround him, some of which are highly destructive to the powers of life, we see there must be an intimate connection between this system, which is endowed by nature, with the capability of making a choice, and the other systems. This must therefore regulate the others. But as it must be supplied itself, with energy, by the Ganglionic System, we may perceive how intimate a connection between these two, must always exist.

Hence derangements in the functions of the latter, so frequently excite diseases in the former, and *vice versa*. There is, however, a very material advantage derived from this circumstance, in the treatment of diseases, of the cerebral system, as we are enabled to relieve diseases of that class, by acting with medicine on the Ganglionic Viscera.

However, to enter fully upon this point, at present, would lead me from the immediate object of this treatise. I have therefore given only this general view, of the principles which are acted upon, in investigating the nature and treatment of the two following diseases.

CHAP. II.

TETANUS.

SECT. I.

History of the Disease.

As it would be unnecessary here, to enter into a minute detail of cases of this disease, which when compared together, would afford little or no variety, from the course of symptoms usually related, by writers on this subject ; I shall for the present state only, the result of my observations.

It matters little from what exciting cause Tetanus may take its origin, for when once formed, whether on account of wounds or idiopathecally, the same course of symptoms follow.

The disease sometimes comes on suddenly, to a violent degree, but more generally its approach is indicated by a sense of stiffness in the back part of the neck, which gradually increases, till by degrees all the muscles of the neck become affected with spastic rigidity. And owing to the great difference of strength between the muscles which close the jaw, and those which serve to depress it, the teeth are set so closely together, that they do not admit of the smallest opening. The utmost violence of spasm is not constant; but after a few minutes subsides a little, not, however, affording such relaxation in the muscles as would allow the action of their antagonists.

This affection of the muscles of the head, is soon transmitted by succession, to all the muscular parts of the body. But it is worthy of remark, that there are some muscular parts which resist the effects of the disease, for a considerable time, and fall into the general destruction only towards the fatal period.

These muscles may be divided into two classes, the one comprehends all the muscular parts of the thoracic and abdominal viscera, and the other all those which belong to the organs, of any of the five senses.

Thus it is observed that the Ganglionic functions are little affected, vomiting sometimes occurs, but generally does not continue. It is usual enough for the appetite of hunger to remain through the whole course of the disease, and what food happens to be taken, seems to be regularly digested; the urine is regularly secreted, although sometimes retained, and is voided with difficulty and pain. When the spasms are violent, the pulse is contracted, hurried, and irregular; but the respiration is affected in like manner, and during the remission, the pulse and respiration usually return to the natural state.

With respect to the second class, we observe that the tongue retains its mobility for a considerable time, the arms also do not become affected, till long after the lower extremities, and even when the muscles belonging to them are affected with spasms, those alone escape which move the fingers, and those often retain their mobility to the last. The head also in this disease, is seldom affected with dilirium or even confusion of thought, till the last stage of it, when by the repeated shocks of a violent distemper, every function of the system is greatly disordered.

By reflecting on these phenomena of the disease, we are led to observe, that the thoracic and abdominal viscera, are not primarily affected, and that the disease, cannot take its rise in the nervous substance, supplying these organs, for were it so, these viscera must immediately take on diseased action.* Hence it must be concluded, that the Ganglionic System, is not the seat of the disease. The same argument is applicable to the cerebral system, comprehending the intellectual powers and the five senses.

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* Some Authors have, indeed, mentioned morbid appearances on dissection, in these parts; but they were evidently the effects of the disease, or of the remedies employed for its relief.

There are circumstances which even show, that these systems, have rather a tendency to oppose the disease, than to participate in its effects: thus, we observe that the tongue, which is the principal organ of taste, retains its power of free motion, until the cerebral system becomes affected. Now we know that the gustatory nerve, is a branch of the fifth pair, which properly belong to the cerebral system, while the ninth pair are acknowledged to be those which supply the muscular parts of that organ; and are found to arise from the inferior part of the corpora pyramidalia, to go out of the skull by their proper holes, in the occipital bone. We also observe, that the principal organs of touch, are in the hands, which in man, are placed in the upper extremities. The nerves of touch should then, in this situation, oppose the effects of the disease. This we find to be the case, as I observed before, that the upper extremities remained a long time exempt from spasm, and that the fingers often continued so to the end. The opposition of the cerebral, to the action of the spinal system, in Tetanus, is very plainly shewn at the commencement of the disease, when in a mild state. For then the spasms are most frequent, immediately on the patient inclining to sleep. This is often so obvious to the patient himself, that the dread of the recurrence of spasm, is sufficient to keep him in a constant state of anxiety and watchfulness.

Having thus explained how these two systems do not appear to be the seat of the disease, we must naturally conclude that it rests altogether in the other system, or that of the spinal canal. Every circumstance of the disease conspires to substantiate this idea. We observe that the only parts of the body which are engaged in the disease, from the commencement, are those constituted of muscles; but, upon dissection there is not the slightest injury to be discovered in their structure. Now we know that the nerves, which are distributed to those parts, and are the proper stimulants to muscular action, in the living body, all take their origin from the nervous system of the spine. It is natural to conclude, that as we cannot discover, in examination, after death, any morbid change in the parts which are acted on by the disease, we should expect to meet with some change in the parts which afford the stimulus to muscular action; hence the disease must be seated in the nervous system of the spine. When we examine the bodies of those in whom the disease has proved fatal, we can no longer have any doubt that this is the fact.

Before we proceed any farther, it may be necessary to shew that this fact has not been taken notice of, by any modern writer on Tetanus, and that the latest publications, seem to regret their want of information, as to the nature, or real seat of this disease.

The generality of writers, on this disease, seem to think, that no morbid appearances can be detected on dissecting subjects, who have been cut off by Tetanus. **Mr. Larrey** mentions a case where there was a contracted state of the pharynx and œsophagus, attended with a red inflamed appearance of the internal membrane, which was covered with a viscid redish mucus. This however, could only be the effect of disease, as may be clearly deduced from what will be said relative to this part, when we shall be treating on Hydrophobia.

In the seventh volume of the Medico Chirurgical Transactions, where Sir **J. M'Grigor**, describes the diseases, to which the British army were liable, during the late peninsular war; with respect to Tetanus, he observes, that he was "at some pains to collect information "relative to a disease, which was too frequently "fatal among the army; for among several "hundred cases detailed, there are few where "this disease had made any progress, in which "the remedies, however varied, seemed to "have any influence on it." Yet he does not seem to have obtained any information respecting the nature of the disease, as would appear from his next observation, where he says, " The remedies which have been chiefly " trusted to, for the cure of this formidable disease, are—opium, mercury, wine, the warm " and cold bath, venesection, ipecacuanha, and " digitalis, in large doses; enlargement of the " original wound, and amputation of the limb. " These have been tried alone, and in various " combinations; and I am obliged to confess, " that the whole failed in almost every acute " case of Tetanus, which occurred. The three " first have been administered in unlimited " doses, without effect; the cold bath is worse " than useless." And a little after he observes, " I am however, obliged to confess, that little " or no dependance, is to be placed, in any of " the remedies; and I have to regret, that the " method of cure, is as yet to be discovered."

Mr. Abernethy observes, that in four cases, where he enquired into the state of the bowels, the evacuations were not like fæces, and he proposes, as a question, in investigating the cause, "What is the state of the bowels between the infliction of the injury and the appearance of this dreadful malady?" And in another place he expresses his opinion, that—"The seat of this disease, should be looked for in the stomach."

In the cases lately published by **Dr. Dixon**, with respect to the pathology of the disease, he says, "I am unable to say any thing satisfactory; nor have the dissections been sufficiently numerous to allow us to judge, how far it has any essential connection with such morbid appearances as have been discovered."

Dr. M'Arthur has published some cases, where he observes, "a yellow matter, found in the stomach, and intestines, was very remarkable;" but asks, "Is it to be considered a feature in the disease? Or was it in consequence of the quantity of laudanum exhibited.

As it would be endless to quote the observations of authors, in support of the idea, that the disease has never been considered in the point of view, which is capable of explaining all the phenomena, attendant upon this dreadful malady. I will now proceed to state the morbid appearances, which occurred in examining the cases, which came under my own inspection.

SECT. II.

Morbid Appearances.

In the first two patients, which I had an opportunity of examining, the disease did not prove fatal, until the fourth day. No morbid appearance could be discovered in the viscera of the thorax or abdomen. The only appearance of disease, that could be observed in the brain, was some increased vascularity, particularly in the membranes; but there was a considerable quantity of water flowed from the spinal canal, after the brain had been removed.

On the 25th of February, having occasion to visit, about three miles from town, I was requested to see a boy, aged thirteen, who, the night before, had received a severe burn in the toes of the left foot. I was informed he was a beggar, who went about the country, exposed to the vicissitudes of the weather, during an inclement season; and that the evening before, he went to rest in a lime kiln, where he was found, the next morning, in the state I saw him. Having no friends, nor habitation, I directed that he should be sent to the Richmond Surgical Hospital, where he remained under treatment, for four or five days, when Tetanus came on, with the usual symptoms, and in thirty-six hours after the first attack, he expired. I did not however, see him again until after he died.

On examination of the body, after death, the viscera of the abdomen and thorax appeared perfectly natural, and there could not be discovered any morbid appearance in the muscular parts. The brain appeared healthy in every respect, except some increased vascularity in its investing membranes.

Upon opening however, the cavity of the Spine, from the back part, there appeared to be a fatty substance,* deposited in the cellular tissue, investing the dura mater, for the extent of several of the dorsal vertebræ. On raising the nervous mass (with its dura mater entire) from the Spine, there appeared a considerable effusion of blood into the cellular tissue, connecting it to the upper lumbar and lower dosal vertebræ. A similar effusion occured also along the bodies of the upper dorsal, and two inferior cervical vertebræ. On slitting up the dura mater, on its anterior surface, or that next the bodies of the vertebræ, the nervous mass appeared highly vascular, and the vessels, of every description, remarkably tortuous. In the part which was situated opposite to the ninth and tenth dorsal vertebræ, there appeared a whitish substance very nearly resembling the medullary matter effused between the arachnoid coat and pia mater, occupying the space of about an inch and half, and covering about half the circumference of the nervous mass. On breaking the membrane inclosing it, I could wipe it off, and there could not be the slightest rupture discovered in the pia mater, or any of its vessels. The only appearance in the nervous substance itself, that I could discover, was a deeper tinge than natural, in its cortical and medullary parts.

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* Since writing the above I find that this fatty substance is natural to the part. It was taken notice of in the examination of this case, on account of its being absent at both parts of the column, exactly opposite to where the extravasation was afterwards found, on raising the mass from the vertebræ.

The remarkably circumscribed appearances, of both the extravasations of blood, which have just been described and which may be viewed in the accompanying plate, would at first lead one to imagine, that these were the result of local injury. We find, however, a very satisfactory proof, that a general affection, such as this, may be capable of causing such local effects, in the accounts lately published by **Dr. Horsefield**, of the effects of some Indian poisons.

He observes that in animals killed by the antsher,* the large vessels of the thorax, the aorta and venæ eavæ were in every instance found excessively distended. The surrounding viscera, especially the lungs, were gorged with blood, of a florid colour and completely oxiginated. When the vessels were punctured the blood sprung of out as from living vessels. The stomach was unusually distended with air. But the brain was less indicative of morbid effects, than the viscera of the thorax and abdomen. In some instances it was perfectly natural—in others slightly inflamed.

Those destroyed by Tshettik were very different. The viscera of the abdomen and thorax, were found nearly in their natural state, as were the vessels leading to and from them. The brain and dura mater, on the contrary, exhibited marks of violent action. In some instances the inflammation and redness of the dura mater were so strong, that they at first appeared as the consequence of a blow, previously received. But afterwards it was found, by repeated experiments and examinations, that these were universal appearances, after death by Tshettik. It is obvious that whenever the spinal canal was examined, in subjects dead of Tetanus, that the effects of the disease must have been observed, I may therefore adduce a few instances where morbid appearances, of this system, have been taken notice of by medical writers; but it is evident they derived little advantage from what they observed, as it seldom had any influence on their practice, and ceased at length to be regarded at all, by modern practitioners.

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* The upas formerly so celebrated, especially in the very figurative language of Dr. Darwin.

The following passage from Burserius will sufficiently prove, that morbid appearances have been observed, in the nervous system of the Spine, by several who examined that part, in those who died of Tetanus.

/t " Anatome delexit præcipuam sedem morbi,
" quando primarius, atque idiopathicus est
' cerebrum esse et spinalem medullam sed
" frequentius et certius hanc postremam. Id
" jam cognovit Fernelius deinde confermave- i
" runt plures alii. Lieutaudius in spamsis ac sm
" convulsionibus, in quibus sensus et linguæ
" usus servatur, medullam spinalem affici non
" dubitat, atque inter ejus involucra ut pluri-
" mum humorem aqueum effusum repariri e
" affirmat. Eamdem tuetur sententiam, Bil-
" fingerus, imo supremam medullæ spinalis
" partem speciatim laborare existimat, et si
" unquam in cerebro vitium fuit, ex eodem in
" medullam spinalem illud propagari conten-
" dit. In viro quem inter alia postremis vitæ
" diebus, excruciaverant, superiorum artuum
" tonicæ convulsiones, per intervalla recurren-
" tes cranii fornice et subjecta crassa meninge
" ademtis paucæ effusi sanguinis guttæ, supra
" tenuem meningem sub vertice conspectæ
" sunt prope latus sinistrum longitudinalis si-
" nus: vasa autem quæ per eamdem hanc
" meningem, hemispherium cerebri dextrum

" convertentem replebant, valde erant sanguine
" distenta et nigricantia. In anfractibus cere-
" bri totius stagnabat aqua ferme limpida. In
" ventriculis aquæ vix aliquid. At multa ad
" magnum capitis foramen sic ut pronum esset,
" intelligere illac in spinæ tubum non defluere
" potuisse, ex quo reapse mox effluxit cum spina
" ad imam thoracis partem dissecta est: Obiit
" ex tetano in Nosocomio Bononiensi ann 1752
" vir sanissimus, ex optimo corporis habitu
" præditus qui in morbum ex suscepto post lar-
" gam vini potationem ingenti frigore incide-
" rat. In cadavere ejus dissecto inventa est in-
" tra duram et piam matrem, qua medulla spi-
" nalis cingitur, magna vis seri viscidi et fla-
" vescentis. Observationem apprime similem
" habet Cl. Zullattus de Tetano ex eadem
" propemodum causa nato, in quodam Pistore,
" in ejus cerebri ventriculis et tota fere me-
" dalla spinalli inventum est serum viscidum,
" flavum et non nihil acre. In sectione ho-
" minis opisthotonos defuncti cujus historiam
" nobis reliquit Bontius apparuerunt cerebri
" ventriculi materia viscida glutinosa, lutea vi-
" tello ovi persimili, et non parum fætente

" oppleti. Serum quoque perpaucum quidem
" sed salsum in sinistro cerebri ventriculo re-
" perit ejusdem juvenis quem Tetanus confe-
" cerat Cl. Valsalva. in alii vasa tenuis
" meningis turgida et sub eadem humor gelati-
" næ instar occurrerunt. Vasa autem piæ matris
" supra lobum posteriorem utrumque sed ma-
" gis sinistrum infarcta sanguine in* cadavere
" tetano perempti ita erant ut purpurasceret.
" Sub eadem tenui meninge stagnabat humor
" lentus, albidus ad utrosque lobos late effusus.
" In occipite vero ad cerebelli basin seri rubelli
" cochleare, deprehensum est, referente Hae-
" nio. Sed in his postremis observationibus nulla
" fit de spinali medulla commemoratio. Si ea
" fuisset inspecta aliquid fortasse, quod superio-
" res confirmaret, exhibuisset. Postremo ex Cl.
" Morganii, monito non tantum ad copiam
" humoris effusi aut stagnantis, sed potius ad
" acrem irritantemque naturam his in casibus
" attendere oportet."

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* Institutiones Medicinæ, Vol. III. Cap. 8, CCCLVI. Page 210.

As this author has quoted so many authorities, in support of morbid affections of the spinal system, in Tetanus, it is quite unnecessary to enter into any farther discussion on the subject.

From the morbid appearances just enumerated, it seems evident, that the disease is of an inflammatory nature. It would also appear, that its principal seat is in the membranes, investing the nervous mass of the Spine; for we can observe here, the peculiar characteristic of membranous inflammation, in the remarkably tortuous state, of the vessels of the part.

As it is evident, from dissection, that the nervous mass of the Spine, is affected in this disease, with such local injury as has been just described. We can in a satisfactory manner, account for some peculiar circumstances, which occur in the course of the disease. In describing the symptoms of Tetanus, authors have remarked, that the body is sometimes bent in different directions, according to which, they have often denominated the disease. Thus if the body be rigidly bent forward: it is styled emprosthotonos; if to one side Tetanus lateralis, if bent backward they have called it opisthotonos. SAUVAGES has even described a universal affection, which he denominates holotonicus and when particularly affecting the neck, he calls it Cervinus. From what has been already observed, it is obvious that any of these affections may occur in the disease, according to the situation in the spinal canal, where the effusion may chance to take place.

It is another remarkable circumstance, in the effects of this disease, that when it has not been so violent, as to destroy the patient, before the third day, a watery or other fluid will be thrown out in the spinal canal. And this may always be expected to occur where the disease, has been of long continuance.

A very curious circumstance is, that we can produce this disease, by artificial means; for when an animal has been decapitated, if we instantly introduce a slender wire down the Spine, so as to irritate that nervous system, without compressing it completely, the muscles of the animal, are immediately thrown into that state, which is peculiar to Tetanus.

SECT. III.

Causes.

The causes of Tetanus, may be divided into those which give a predisposition to the disease, and those which immediately excite it.

The exposure of the body, to the vicissitudes of the weather, appears to be the most general predisposing cause to this disease. Thus we observe that in the army, it is prevalent, during the campaigns, where the men have been exposed to the inclemencies of the season. It is, however, a remarkable circumstance, that this dreadful malady is very seldom met with, even in its slightest stages, among the navy, while it is found generally fatal to military men. It may appear strange, that the vicissitudes of the weather, should be esteemed a predisposing cause, while we observe, that Tetanus, is so very rare a disease, among seamen, who are continually exposed to its influence. But when we reflect upon the nature and habits of the two professions, we may, in some degree, develope this mystery. In the sea service, the men, although exposed to changes of wet and cold, yet, on account of the regularity which is observed, in the naval service, the constitutions of the individuals, become habituated to the changes of the atmosphere. On the contrary, the soldiers, while in barracks, are completely defended from the severity of the seasons; but on entering the scenes of action, they become exposed to all the various changes of the weather. This is particularly hurtful to them, during the dampness of the nights, when they are often obliged to sleep in the open air.

It may be useful to take notice here, of another circumstance, which gives a predisposition in soldiers, to this disease, and to which sailors are not exposed. We observe that soldiers are, unavoidably, obliged to carry a certain portion of their luggage, in their knapsacks, on their backs. Now we know that in an active campaign, it is impossible for nature to adapt itself to the various changes, which must occur in the temperature of the parts, in the vicinity of the Spine, by wearing the knapsack or not, at such uncertain periods.

Indeed, circumstances analogous to this, would seem to account for horses being more liable to this disease, than any other quadruped.

The great damps which occur during the nights, in hot climates, would seem to be sufficient reason, why these affections should arise, more frequently in warm climates, than in cold ones. Hence they are very apt to occur there, when much rain or moisture succeeds excessively dry or sultry weather.

Indeed from all I have been able to learn from books, or from what has occured to my own observation, I am led to think it certain, that a predisposition to the disease, by exposure to irregular vicissitudes of temperature, is absolutely necessary to the production of the disease. So strong is the predisposition, after such exposure, that the slightest accident may give rise to Tetanus, while every practitioner may recollect, the most extensive lacerations, without the disease having been induced.

I remember a boy, aged 15, who had been driving cattle into town, from some distance in the country, during a very severe winter season; feeling himself fatigued, he got behind a carriage; but not being able to retain his position on account of the cold and wet, he was thrown from thence on his back. In about four hours after, symptoms of Tetanus set in, and he was conveyed to the Richmond Surgical Hospital, where the disease gradually increased, notwithstanding the active remedies employed, for his relief, and on the fifth day he expired. On examination, after death, not the slightest external injury could be discovered. There have been cases recorded, where the disease came on by mere exposure of the body, to a cold breeze, while over heated by exercise.

But it is evident, such circumstances, may, and have frequently occurred, without the disease having been induced.

All ages, temperaments, and complexions, are liable to Tetanus; but the male sex, is more frequently attacked with it, than the female; and those of a robust and vigorous constitution, more frequently, than those of a weak habit.

An idea is entertained by many, that the negroes, are more predisposed to attacks of Tetanus, than white people. It is obvious, that in the West Indies, the former are not, by any means, so well defended, from the inclemencies of the heats by day, or damps which occur during the night. Hence, we certainly find them more frequently afflicted with Tetanus than the Europeans. M. Larrey, observed, that gun-shot wounds, in the course of the nerves, and such injuries of the joints, often produce Tetanus, in the climate of Egypt: particularly, he says, when the weather, or temperature, passed from one extreme to the other, in damp situations, and in those which were adjacent to the Nile, or the sea.* What he terms dry, and irritable temperaments, were the most subject to this disorder, the event of which, was found, to be almost always fatal.

The exciting causes of Tetanus, are extremely various. But it most generally happens in consequence of wounds. It is often surprising, how slight the wound may be, which will be capable of producing the disease. I have been told of one case, where a coachman, received a slight stroke under the eye, by a lash of a whip, which did not even break the skin. Yet, it was followed in a few days, by Tetanus.

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* Larrey, Mem. Chirurgie Militaire.

Severe burns, on the extremities, when the substance of the part has been destroyed, are very generally attended with this disease. A slight splinter under the nail, has been known to have excited Tetanus.

Injuries, or derangements of internal organs, do not appear to have much tendency, to produce this affection.

Indeed, I have not been able, as yet, to find any case, recorded of true Tetanus, which arose from internal injury, whether in the alimentary canal, or elsewhere. It is true, that some symptoms, like Tetanus, have been observed to arise from different irritations in the alimentary canal. But when we shall come to speak of the diagnosis in Tetanus, we may be able to point out a distinction, between an affection of this nature, and the true disease.

SECT. IV.

Diagnosis.

It may appear almost unnecessary, to make any remark, upon the diagnosis of a disease, which is, in general, attended with such peculiar symptoms. Yet, as it is often of the utmost importance, to ascertain the nature of the disease, before it has been completely formed, we may point out here, some affections, which may be mistaken for approaching Tetanus.

The first symptom that generally attracts the notice of practitioners, in this disease, is that contraction of the muscles of the jaw, by which it is closed. The disease has on this account, often been denominated, trismus, or locked jaw.

Even **Dr. Cullen**, considers this, as a species of Tetanus, defining it a spastic rigidity of the lower jaw. This has been the source of many mistakes, in the nature and treatment of true Tetanus. For we find, that this affection of the jaw, is symptomatic in a variety of diseases, which are incident to the digestive organs. As the nature of Tetanus, will point out a peculiar mode of treatment, it may be of use here, to shew some distinction, between the affection of the jaw, as symptomatic of general Tetanus, and that originating from other causes.

It is obvious our Diagnosis will be considerably assisted, by ascertaining the presence or absence of the predisposing and exciting causes of the disease, which have been already noticed.

There is, however, one circumstance in the affection itself, that would appear to mark the distinction pretty clearly. We find that where Trismus has been followed by Tetanus, that the spasm of the muscles does not continue permanent. And we observe, that although the jaw cannot be opened, the muscels do not afford the same sensation to the finger of the practitioner, when actually under the influence of the spasm and otherwise.

When the trismus, is induced by an affection of the nervous mass, seated in the spinal canal, the muscles while affected with spasm, will afford to the finger, a sensation as if it were possible to reckon the number of fassiculi of fibres, which constitute them, or they give a feel similar to that of a meshwork of rigid chords. Indeed when the disease, has considerably advanced, this state of the muscles remains permanent, especially in those of the abdomen.

On the contrary, when trismus has been induced, by irritations in the primæ viæ, or by sympathy with other internal organs, the jaw is generally more fixed, and is not subject to that regularity of relaxation and spasm, which has been observed in Tetanus. When we pass our fingers over the muscles, we find, a very different sensation in this case, from that observed in Tetanus. Here although the muscle may feel hard, yet, it affords the sensation of a smooth surface, like one whole natural contraction.

The want of this diagnosis, has been the source of a great variety of opinions, with respect to the treatment of this disease, as will be evident, when we come to an examination of the remedies, adapted to the cure of Tetanus.

Physicians seem to have felt it necessary to form some diagnosis in these affections. We find them, therefore, in one instance, give this affection a peculiar name, when the disease was evidently caused by retained meconium. Hence the term trismus nascentium.

It may be asked here, why an affection of the muscles of the jaw, should be more generally the consequence of internal irritation, than other muscular parts of the body? We find, however, that although this circumstance may attract more notice, as threatening greater disturbance to the system: yet the other extremity of the alimentary canal, is much more frequently affected, as we find few local irritations, of this part, which are not at first, attended with constipation.

Now, we observe a constant law, in the animal economy, that when an irritation occurs in the internal parts of an organ, its effects will become perceptable at the extremity of its duct or canal. Thus irritation in the urinary bladder, will give a sensation at the extremity of the urethra, &c. &c. It would be impossible therefore, to exclude the alimentary canal, from a law to which all other parts, in similar circumstances, are liable.

The spasmodic contraction of muscles, from irritation of the bowels, is not, however, always confined to the extremities of the canal. I remember a child, who was suddenly affected with spasm, of the muscles of the hand, which permanently closed the fingers for several days. They could not be opened by any force that it was proper to employ. But by the determined perseverance in the exibition of purgative medicines, which caused a quantity of greenish fæces to be discharged, the spasm of the fingers relaxed as suddenly as it had at first come on.

SECT. V.

Prognosis.

The prognosis in Tetanus, has hitherto been always most unfavourable indeed, the ancients generally considered this disease as incurable.

It has been observed in general, to be, more fatal when arising from a wound, than from any other cause. It is even possible often to foretell the approach of Tetanus, by the state of the wounded part. Thus we observe, that when the disease is forming, the wounded part appears destitute of that inflammation, which is necessary to support the healing process. This occurrence happens with inflammations, situated in any part of the body: tumors will often diminish or disappear altogether, previous to the appearance of the disease. Dr. Lionel Chalmers, of Charles-town, South Carolina, states that "when the disease forms very quickly, and invades the unfortunate individual, with the whole train of its mischievous symptoms, in a few hours, the danger is proportionate to the rapidity of the attack," and he observes, that "patients thus seized, die in 24, 36, or 48 hours, and very rarely survive the third day; but when the disease, is less acute, few are lost after the ninth or eleventh day." When the spasmodic contractions quickly succeed each other, and are excited by very slight cause, it is obvious that the disease is more dangerous, than when there is a considerable interval. One of the principal symptoms, however, from which we can, with some certainty, form our prognosis, would appear to be, the state of that rigidity in the muscles, which has before been described. As it must be favourable or the reverse, in proportion as this affection is absent or present.

There is a circumstance, which, if the fact, would be of considerable importance in forming our prognosis. It has been always observed, that the inflammatory appearances of the wound, when that has been the exciting cause of the disease, have considerably diminished, previously to its developement. This has been so frequently remarked, that some authors recommend, as a means of assisting in the cure of the general disease, to bring back the inflammation to the wound. Now the more extensive the lasceration and injury of the wound, the more tendency it would have to keep up inflammation in the part. Hence we might be led to imagine, that the slighter the injury is, which has excited the disease, the more violent will be the symptoms, and the quicker will its course be terminated. This circumstance appears sufficient to account for Tetanus sometimes occuring in its chronic form, after extensive injuries.

As however, I have not yet had sufficient opportunities to determine this as a fact, it must be left to future observation to ascertain.

SECT. VI.

Treatment.

When speaking of the diagnosis of Tetanus, we observed that the spasmodic contraction of the muscles of the jaw, occasioned by any cause whatsoever, was considered a symptom of this disease. But as I have endeavoured to show that such an affection may arise from other causes, it is obvious, that medicines which were successful in removing or alleviating the primary affection, may have succeeded in dispelling the trismus or locked jaw. Many remedies, which had this effect, have been recommended in the treatment of Tetanus. But not proving even generally successful, they have given place to others, which in their turn have fallen into disrepute. Numerous examples of this may be quoted, it will be sufficient, however, here to notice a few. We, find, a case recorded where the spirit of turpentine was given internally, by the effect of which a large lumbricus was discharged from the bowels, although the patient was not before known to have been affected with worms: yet, this remedy does not appear to afford any remarkable benefit to patients labouring under Tetanus. The trismus nascentium is cured by purgatives alone; yet, this treatment, when not accompanied with other powerful assistance, affords little relief in this disease.

From the rapid course which Tetanus frequently takes, towards a fatal determination, it is evident that little time should be wasted in random experiment. When we examine the various modes of treatment, in cases of this disease, which have already been recorded, we may be struck with the idea, that no single remedy can be always relied upon, in the treatment of such an affection. As, however, almost every writer on this disease, gives an account of cases which were successfully treated by some favourite remedy, which has not proved equally efficacious with succeeding practitioners: it is evident that the action of remedies, must be regulated by certain powers of the animal economy, for we know that the medicines themselves should always be the same.

When we bear in mind the operations of the different nervous systems, which have been taken notice of, in a preceding part of this treatise, we may be able, in some degree, to form a just idea, of the advantage of the different remedies, which experience has proved to have been efficacious.

From what has been said of the morbid appearances of Tetanus, in the treatment of the disease, they would seem at first view, to indicate, blood-letting, as the principal remedy. There are however, many arguments, which would prove the impropriety of such an operation, we know, that by general bleeding, the sanguiferous system in the brain, is principally affected; by which means, the energy of that organ may be diminished, even so far as to induce syncope. In relating the phenomena of Tetanus, I have shewn that the nervous system of the brain, seems to resist the disease. By abstracting blood, therefore, it is evident, we weaken one of our most powerful antagonists to the morbid action; and thus diminish our powers of resisting the general destruction. Experience also shows, that when blood has been drawn, it has at least done no good, and seldom or never exhibited that buffy coat, which is so generally met with in all other inflammatory cases.

We find, when Tetanus has been excited by a wound, that the inflammation attendant on the injury, has previously receded. Some practitioners, have been led to endeavour to bring back the inflammation, by stimulant applications. Experience, however, has not proved, that this practice has been attended with advantage. Indeed it is evident, that to irritate the wounded part, can only tend to add to the original exciting cause of the disease. But as we have observed, that the disease has a tendency to lessen inflammation in other parts of the body, when we excite it in a part remote from the wound, I would imagine, that it could have some effect in weakning the force of the symptoms. Now I have shewn, that the disease is seated in the spinal canal, and as it is obvious, that external inflammation would have effect, in proportion to its vicinity to the seat of the disease, we may be led to expect some advantage from a blister along the spine. This has been tried with success, in a case related by Dr. Carter, in the Medical Transactions. He, however, assisted its efficacy, by employing, at the same time, some powerful cathartics.

There is another circumstance, in favour of applying a blister along the whole length of the spine: we find, that the disease, when chronic, has a natural tendency to throw out a serous fluid into the spinal canal, which is similar to the discharge of the blister. By exciting therefore such a discharge, externally, it is evident we may prevent, the internal determination.

On the same principles, we observe also, that mercury, may afford considerable relief, in the chronic state of Tetanus, when employed in sufficient quantity, as to occasion ptyalism.

In the treatment of Tetanus however, there are many objections to the employment of medicines, which require time before they produce the wished for operation. Indeed, the observation of Dr. Latham, when reflecting upon the treatment of some cases, of this disease, which he has given in the transactions of the London College of Physicians, deserves particular attention. " In Tetanus," he says, " the opportunity soon slips away, if we do not immediately bring our ideas, imperfect as they may be, to the test of experiment. Whatever predisposing cause therefore, may be supposed to influence the production of this disease, and whatever morbid susceptibility of system may favour its formation, let us act instantly and vigorously. Let us consider the disease, on the same broad scale as other acute diseases, which affect the whole system, and immediately by relaxant and sedative powers combined, moderate the excess of action, and if the disease should fortunately remit, so as to allow of the propriety of the exhibition of tonic, and other correspondent powers, let us, as in other general diseases, adapt these when necessary to existing circumstances."

When I was speaking of the distinction, between the functions of the ganglionic and spinal systems, it was observed, that the latter, influenced the deposition of new matter, throughout the body. It is evident, therefore, that in a deranged state of this system, the functions of the ganglionic, must be considerably impeded by accumulation, in its different viscera. Hence, various unnatural substances are thrown into, or formed, in the alimentary canal. We must, therefore, perceive the necessity of employing purgative medicines during the course of this disease. Indeed, so great derangement has been often observed in the ganglionic viscera, after this disease, that many have been led to think, that Tetanus arises entirely from the morbid state of some of these organs. Thus, MR. ABERNETHY advises, that the seat of the disease should be looked for in the stomach. It is obvious, therefore, that we should pay considerable attention, to the state of this system, in the treatment of Tetanus.

When we examine, what effect has attended the employment of purgatives, we find experience has proved, the great utility of them, in this disease, particularly in the West Indies. Some late writers in that quarter, state, that since the introduction of this treatment, the disease has been by no means so fatal there, as formerly.

With respect to the choice of purgatives, they must be of the most active kind. Should any particular viscus have been affected with disease, previously to the attack of Tetanus, we should bear that in mind, when considering what medicines are best adapted to produce the desired effect.

The affusion of cold water, has frequently occasioned an evacuation from the bowels, even when internal medicines have failed to produce such an effect. Hence, we may expect some advantage from it, with this intention, in Tetanus. But, as this remedy, has considerable effect upon the seat of the disease, the employment of it has been extolled by several, as having been attended with the greatest success. In the sixth volume, of the Medical Observations and Enquiries, **Dr. Wright**, has published a narative of the first trials of this method, which were all successful. The way adopted consists, in plunging the patient in cold water, and in that of the sea, when at hand, in preference to any other; or else, in throwing from a height, several pails-full of cold water, over his body; after this has been done, he is to be very carefully dried, and put to bed, where he should be only lightly covered with cloths, and take twenty or thirty drops of laudanum. The symptoms usually seem to give way, in a certain degree, but the relief which the patient experiences, is not of long duration, and it is necessary to repeat the same measures, at the end of three or four hours. They are to be repeated in this manner, at such intervals, until those of freedom from the attacks of the disorder, increase in length. This desirable event, gradually soon follows, and ends in a perfect cure.

We do not however find this remedy, attended with such complete success in these climates, and from what has been said of the nature of Tetanus, this remedy, would not appear to have so decided an effect, as blistering along the spine. Besides this, it must be attended with considerable torture to the patient, as the slightest movement, will often be sufficient to excite the spasm.

There are numerous cases on record, which are said to have been overcome by opium, given in excessive quantities. Indeed, it sometimes may have been a very efficacious remedy; but from the same source of knowledge, we also learn, that it has often failed. Even when success has attended, the excessive exhibition of opium, the constitution of the patient, has been materially injured, and the function of the alimentary canal, has continued afterwards for a considerable time, very much deranged. When this medicine, has been principally relied on, for the cure of Tetanus, it produces this effect, by its sedative power on the general frame. Now, in explaining the nature of this disease, it was shown, that Tetanus is peculiar to one system only. We should therefore, rather wish to support, than to repress the actions of the others. Hence, it would be preferable, to direct the force of this medicine, against the diseased system, by combining it with other medicines, calculated for the purpose, than to allow its action to be general; which must be the case, when it has been exhibited alone.

When we consider that muscular power, appears considerably exhausted, after long or violent exertion, and that most generally the effect of such exhaustion, is profuse perspiration. We may conclude, that where profuse perspiration occurs in disease, that the powers of the nervous system of the spine, must be weakened. This we find, to be the fact, as no disease is attended with greater debility, than that accompanied with this symptom in excess. Now, as this disease is the extreme of action in this system, which would become paralysis, if the effusion on the membranes enveloping the nervous mass, were to amount to compression; it is evident, our principal object in the treatment of Tetanus, should be directed to weaken its energy. To procure free and copious perspiration, would appear, the most efficacious method, of accomplishing this end.

In the compound powder of ipecacuanha, we have a preparation, very powerful for this purpose. For by this combination, the whole force of the opium, which is supposed so powerful in this disease, is directed to the proper point.

The efficacy of this mode of treatment, is abundantly conspicuous in the excellent relation of some cases of this disease, by DR. LATHAM, to which I had before occasion to refer. And it has also been remarked there—"It may often be necessary to assist their action, with some doses of JAMES's Powders."

With respect to our treatment of the cerebral system, in this complaint, we should certainly endeavour to prevent it if possible, from being overcome by the impending destruction. I have shown, in describing the symptoms of this terrible disease, that the brain appears, for a long time to resist its incroachment; we should, therefore, support this system, in the due performance of its functions, by stimulants, proportionate to the necessity of the case: not however to urge them, by any means so far, as to induce the contrary effect. Madeira wine, is by far the best stimulant, that can be employed, to support the energy of the cerebral system, in Tetanus. This may be given to the patient in small quantities, frequently repeated, at short intervals. But it should on no account be given, so as to produce intoxication. This however, can only be ascertained, by the effect which it produces in the patient, and cannot be judged of, by the quantity which has been exhibited: for it will often be wonderful, how large a quantity of wine or spirits, a patient can take in this disease, before it will have any perceptible effect upon him. The advantage of wine or spirits, as a remedy in Tetanus, has been often so conspicuous, that some have imagined the cure of the disease, may be accomplished by it alone. This is one of the examples, where we are often not satisfied with the good effects of a medicine; but finding it of some advantage, when employed in a certain quantity, we push it farther, until we call into action, its deleterious properties.

In Tetanus, there are several other medicines, which may be of use, in conducting the actions of the different systems; but it would be unnecessary to take notice of them here, as it would only be repeating what has been said already, on the principal remedies.

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Having taken a view of the principal remedies, proper to be employed, in the treatment of Tetanus, I may, in a few words, recapitulate, the general treatment for the disease. It is however, obvious, that many particular circumstances may occur, which therefore ought to be left, to the judgment of the practitioner.

When Tetanus is idiopathic, our first proceeding in the treatment, should be to apply a blister along the whole length of the spine: for we find, that in this case, the disease, generally runs through its course, with the utmost expedition. When, however, it has been induced, by an extensive injury, and that from what has been stated, it would appear disposed to take on the chronic form; there is every probability advantage would be derived, by putting the patient under a mercurial course, and the blister, may be held in reserve, lest the disease may suddenly gain strength, before the mercury could take effect.

The bowels should be evacuated once a day, or at least every second day, and when necessary, to employ medicines for this purpose; calomel should be a principal ingredient.

Copious general perspiration, which is most powerful in reducing the force of the disease, should be excited by the compound powder of ipecacuanha, (occasionally assisted, when necessary, by JAMES'S Powder,) and may be given in quantity, of from five to ten grains, every third or fourth hour.

When the cerebral functions are threatened in this disease, we must support this system by stimulants. The Madeira wine, or something of that nature, is the best, and should be given in small quantities at a time, which may be frequently repeated; not however, so as to cause intoxication.

CHAP. III.

HYDROPHOBIA.

SECT. I.

History of the Disease.

THE name of this dreadful malady, although very applicable to the principal symptom of the disease; yet, may lead to some erroneous ideas, with respect to the nature of the dread which patients express at the sight of liquids. Urgent thirst is found among some of the first symptoms of Hydrophobia, and it is observed that this symptom continues to increase, through the whole course of the disease.

Patients often say they would give the universe for drink while it is out of their sight. But upon their attempting to swallow the least particle, the muscles of deglution are immediately thrown into irregular action, and threaten instant suffocation. This irregular action of the muscles, by frequently recurring, in the repeated attempts of the patients to swallow, at length is induced by the very mention or sight of liquids. Some cases are recorded, where even the appearance of a polished surface, has brought on the convulsive spasm, in the muscles of the pharynx. It is therefore evident that it is the difficulty of swallowing, and not the water that causes such terror in the patients. DR. CULLEN, has with great propriety and accuracy defined this disease, "*Potionis cujuslibet, utpote convulsionem Pharingis dolentem cientis, fastidium et horror.*"

HIPPOCRATES has not mentioned this disease in any of his writings. Indeed he describes a species of fever, which was sometimes attended with difficulty of swallowing liquids; but it will appear, when considering the diagnosis, that the difficulty of swallowing liquids in some fevers, could not be considered as true Hydrophobia. It does not follow from HIPPOCRATES not mentioning this disease, that it was not known at his time.* Perhaps it was seldom met with in the place where he lived. For it has been ascertained that it is not equally frequent in all places. AURELIANUS observes, that it is very frequently found to affect dogs, in the island of Crete, although this place is almost entirely free from venemous animals. It is a very rare disease in the West Indies, as mentioned by DR. THOMAS, who concludes that it is not so prevalent among dogs, in warm as in cold climates: for during a residence of many years in the West Indies, he never met nor heard of a single instance of the kind. **Dr. John Hunter**, says that in the hot climate of Jamaica, where dogs are exceedingly numerous, not one was known to go mad, during forty years. **Prosper Alpinus**, has remarked that canine madness, never has been known in Egypt, which is also confirmed by **Volney**,* however, as it is a matter of little importance to ascertain, when this disease first made its appearance in the human subject, it may be concluded, that man must have been obnoxious to its attack, from the time animals of the dog and cat kind, became first domesticated.

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* ARISTOTLE, is the first writer, who expressly mentions this disorder, but he sets down man as exempt from the danger of being affected by it. Plutarch, (Symposiæ 5. 9.) asserts that Hydrophobia and Elephantiasis were first taken notice of, in the time of ASCLEPIADES, the Physician in the days of POMPEY the great, many years after HIPPOCRATES or ARRISTOTLE.

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* Volney, observes, " among the singularities, which appear most extraordinary to a stranger at Cairo, may be mentioned the great number of ugly dogs, which roam about the streets. The mussulmen do not kill them, although held to be unclean; but often throw them the fragments of their tables; and devotees even endow charitable foundations of bread and water for the dogs. These animals have also the resourse of the common sewers, which however, does not prevent them from suffering by hunger and thirst; but it is very astonishing that these extremities never occassion madness. Canine madness is equally unknown in Syria, the name of the malady, however, is to be found in the Arabic language, and is not borrowed from any foreign tongue. In Syria the dogs form a kind of independent body, subsisting on public alms. They are quartered by families and districts, and should one of them happen to pass his limits, a combat

From what has been said with respect to the different nervous systems, which constitute the human frame, the symptoms of this terrible distemper may now be investigated with some prospect of success.

When the human species are the subjects of this disorder, a slight pain in the wound first attracts the attention of the patient. This is often attended with itching, **Dr. Nugent**, mentions a case of a female, in whom two red pimples with white heads broke out, just upon the marks the dog had left, where he pinched

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ensues, which is extremely troublesome to passengers.—The Turks think they preserve the safety of the cities by night, and that they assist in devouring the carrion.

the skin, on the back of her hand. This occured thirty-two days, from the time she was bitten, and the disease appeared the day after. The pains however, usually resemble those from rheumatism, and have been considered as a primary mark of the approach of Hydrophobia, when the disease has occurred in consequence of the bite of a rabid or enraged animal.

When the disease has actually taken place, the patient appears dull and heavy; feels frequently cold, approaching to shivering, attended with great lassitude and disinclination to muscular exertion. Any effort is accompanied with considerable tremor. The entire gesture is characteristic of fear, although the patient himself may feel the greatest courage.

The functions of the alimentary canal, at this time, are undisturbed. Respiration becomes weakened, the breathing being short and hurried, and therefore, the pulse is considerably accelerated.

The functions of the brain are not impeded, being seldom affected with delirium, or even confusion of thought, throughout the whole course of the disease.

It has been said, that patients have been frequently tormented with frightful dreams, of dogs tearing them to pieces, for sometime previous to the developement of the disease. But this could only occur in weak constitutions, and histerical women, who were deeply impressed with their danger, from being bitten. It has always been observed that when the human mind, has been deeply interested in any particular occurrence, it usually forms the subject of our dreams. And what could be more likely to occupy the thoughts of a person who was exposed to the contagion of Hydrophobia, than the dread of the approach of that terrible distemper. If such dreams were to be considered an essential symptom of the Hydrophobia, it would be difficult to conceive how they could arise in a patient, who had never been exposed to the contagion, and therefore could never have expected the disease; but in whom the disease has originated, from other causes than the bite of an animal. When such a circumstance has been observed, it evidently must arise from the fears of the patient, and can never be considered as an effect of the disease.

The snapping which is common in Hydrophobia, and which has been considered as an attempt to bite, is only an irregular, involuntary action, in the muscles of the jaw, and so far are the unhappy sufferers from desiring to injure those about them, that they generally give warning to keep at a distance.

The Pathology of Hydrophobia, has hitherto been involved in considerable uncertainty, Dr. Cullen, says with respect to it, "I find that, I can say nothing satisfying to myself, or that I can expect to prove so to others." However, if the symptoms of this terrible distemper are investigated, upon the principles which have been laid down, when speaking of the different nervous systems, which constitute the human frame, the phenomena which have been a long time observed in the disease, can clearly be marked out, and their true nature can be distinctly understood.

It is evident from the symptoms of the disease, that the Ganglionic System, is not engaged in morbid actions, at the commencement. This system, therefore, is not primarily affected. When the disease has been induced by other causes, than the bite of an enraged animal, it is never attended with delirium in the beginning, nor are the functions of the senses in any way disturbed. Hence it is evident, when terrific dreams have been observed, they cannot be considered as a symptom of Hydrophobia, and must be attributed to the fears of the patient who has been bitten. The functions of the brain must therefore be exempt from the primary symptoms.

The primary symptoms of Hydrophobia, are diminished muscular action, shown by the dullness and disinclination of the patient to move. Any exertion is attended with tremor, which gradually increases, until it amounts to irregular action. This is generally first conspicuous in the muscles of deglutition. The muscular parts are the first which exhibit any remarkable action, in this disease. If, however, at this time the muscles be examined, there will not be found any marks of disease, in their structure. It therefore evidently appears, that the disease must be seated in the source from whence they derive the proper stimulus to their action. This has been shown in a former part, to be the nervous system of the Spine. Having once obtained this clue, the whole mystery of the disease can easily be developed.

Having found that the disease appears to be seated in the nervous system of the Spine, the first circumstance that would seem to claim our attention, would be, to ascertain whether the irregular actions of the parts, to which the spinal nerves are distributed, be owing to increase or diminution of the energy of that system. When the spasms which occur in Tetanus, are compared with those which occur in this disease, there appears a very manifest difference. In Hydrophobia, there is no rigidity of the muscles, for they are relaxed as suddenly as they are contracted, and every exertion is attended with tremor. The motions being tumultuary, inordinate, and interrupted, very properly are considered clonic spasms. This kind of spasm is known to arise in other diseases, where the communication of the nervous influence to the muscular organs, has been obstructed by manifest causes. Thus, it is the subject of common observation, that convulsions close the scene, in disorders induced by excessive evacuations, and worn out constitutions. That they are the effects of narcotics, of deleterious gases, mineral exhalations, and even of stimulants, which exhaust the vital powers. And consequently leave unrestrained the organic irritability.* The clonic spasms of the muscles therefore, in Hydrophobia, are owing to the defect of nervous influence. Hence it is evident that the causes of this disease, must act as sedative against the nervous system of the Spine.

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* By organic irritability, I mean that circumstance which is innate to an organ, and which causes the entire

It may now be interesting to trace the phenomena, which may be expected to arise from the influence of the spinal system being suppressed, before the functions of the other systems become deranged.

It has been stated, when considering the nature of the nervous systems in general, that each had an influence over the others, so as to modify their operations. The peculiar function of the spinal system, was found to consist in supplying the proper stimulus to muscular action, and to influence the deposition of the materials which constitute the various parts of

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viscus to take on the action, for which it was calculated, in its original formation, on the application of stimulus to the whole or any part.

the animal body. If then the morbid poison of Hydrophobia, were to suppress the function of this system, the first symptom of disease, should be a diminution of the various parts of the body, which should become most conspicuous in the muscles of locomotion. It appears that this is the fact, and has been taken notice of by writers on this disease. **BOERHAAVE**, and **VAN SWIETEN**, observed emaciation to be so remarkable in patients, some time before the more evident symptoms of Hydrophobia came on, that they thought this circumstance alone, sufficient to authorise them in classing it among chronic diseases.

Another train of symptoms, which should take place from defective energy, of the nervous system of the Spine, is a general inflammatory diathesis. For as this system influences the deposition of matter throughout the frame, which can only take place in the extreme vessels, if the power of the spinal system be destroyed, while that of the circulation continues unimpaired, these vessels would be incapable of resisting the vis a tergo, or action of the heart and arteries. Dr. Macbride remarks, that so much of the inflammatory character is attached to Hydrophobia, that it has been considered an inflammatory disease, until the appearance of Dr. Nugent's treatise on the subject.

However, at the same time the muscles of respiration become debilitated, which gives, from the beginning of the disease, a peculiar sense of stricture and heaviness in the breast, attended with occasional involuntary sighing ; the breathing becomes short and quick, and thus prevents the necessary changes of the blood, in passing through the lungs. Consequently there must be a considerable difference in the inflammatory symptoms of Hydrophobia, from those usually met with in inflammations from other causes. Thus there is seldom or never any tendency to suppuration, even in the wound itself, when the disease has arisen from a bite. Indeed the wound, has generally a greater tendency to mortification than any other termination of inflammation. As the disease advances, this tendency is often developed in a considerable degree. But as the powers of circulation are at the same time gradually weakened, the blood accumulates in the internal organs, and therefore, the effects should be most conspicuous in these parts. Appearances of mortification in the different viscera, are by no means unusual, on dissection, after death.

The spasmodic affections, of the muscles of deglutition, is a very remarkable instance of the influence of the cerebral system, over that of the Spine. The action of these muscles is not constant; but under the influence of the will. There is no operation in the animal economy, where there is a more complicated action of the muscles, than in that of swallowing liquids. Nature seems to take peculiar care, in this place, for the free transmission of nervous energy. The muscles of deglutition are supplied with numerous ramifications from the fifth pair, besides those proper to their muscular action, which come from the cervical nerves. When therefore the influence of the latter, is impeded or destroyed, the cerebral stimulus excites the organic irritability of the muscles. Which now being in each muscle independant of the other, their action becomes irregular and incapable of following that regular order, which is necessary for the transmission of liquids into the stomach.

This tendency of the muscles to irregular action, when the proper stimulus from their nerves has been interrupted, is not peculiar to the organs of deglutition, but the muscles in all parts of the body, have an inclination to clonic spasm, in Hydrophobia. Thus patients are extremely sensible to all impressions, they appear displeased at even the air blowing on them; and they express the greatest terror on being touched, which almost threatens to throw them into convulsions.

There is a peculiar affection of the muscles of the neck, in Hydrophobia, which does not occur in any other disease; but that in which the function of the nervous mass in the Spine has been destroyed. It is generally overlooked by practitioners, and has been seldom even mentioned in the relation of cases of this disease. Yet it is so essentially necessary, as a consequence of the sedative effect, of the morbid poison, that it can never be absent. Indeed it is derived so directly from the seat of Hydrophobia, that I do not hesitate to put it down as a *sine qua non* of the disease.

The spinal accessary nerve, is formed by some filaments, arising in the neck, and others from the medulla oblongata within the cranium. They all come from the posterior root, which differ on one side from the other, in number, size, and length. Most of the filaments seem simple at their origin. However, there sometimes go from the neck, and generally from the part within the cranium, many little roots, which unite in a large filament, to join the common trunk. All the filaments run upwards. On the anterior surface of the cervical mass, the nerve is covered in part, by the dental ligament and its superior part does not become visible; but between the second and third cervical pairs, where it separates from the spinal marrow. It runs gradually forward, and unites at lenght to the vocal nerve, at the place where they both pass out of the cranium. The branches of this nerve, ramify among the scapular muscles, the sternomastoid muscles and the pharynx.*

This nerve being thus destributed to the muscles, which support the head in the erect position, and give steadiness to its movements: if the energy of the spinal mass be destroyed, this nerve must cease to communicate its influence to these parts. The head therefore, not being properly supported, gets a rototary motion. Any cause affecting a part of this nerve could only become manifest in the muscles which are supplied by that part. The relaxation would then be partial. It may therefore be concluded, that where the debility of these muscles is general, the cause must be a defect of energy, from the origin of the spinal accessory nerve. As it appears from what has been already said, that the cause of Hydrophobia, affects the nervous system of the Spine, by destroying its energy: it is evident that this affection of the spinal accessory nerve, must always be conspicuous in this disease, and may be considered a pathognomonic symptom.

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* I have been thus minute in the description of this nerve, as I have not as yet met it accurately described, in any English Author.

There is a curious law in the animal economy, by which impressions having been transmitted from the cerebral system, to different remote parts of the body, and having excited there a peculiar action in them; if by any other means the parts take on a similar action, by association, the cerebral system becomes affected, as if the cause were originally seated in the brain. After a certain period of life, this law is universal. Thus one stage of the paroxysm, of an intermittent, excites in the mind a sensation of cold, although the surface of the body, be actually above the natural standard of heat. So, also in Hydrophobia, the tremor of the muscular parts, which is always associated with the idea of fear, excites that idea in the minds of the patients. This is often very conspicuous, even in those who were before remarkable for a courageous disposition.

Fear being one of the depressing passions, it would appear, that this was generally one of the first effects of the disease, against the cerebral system. The next, and by far the most formidable blow to the functions of the brain, arises from the debility of the respiratory muscles: by which the blood is prevented from undergoing the necessary changes in the lungs. BICHAT, has very satisfactorily proved, that whatever be the manner in which the pulmonary functions are interrupted, it is always the interruption of the chemical changes, which troubles the functions of the brain. When the blood does not undergo the necessary changes, the energy of the cerebral system must be diminished. I need hardly observe, that this is remarkably conspicuous in Hydrophobia. It may be supposed that were the blood to be thus affected, a blueness should be observable in the countenance; but this could not be in any considerable degree, as the blood is accumulated upon the internal organs, and the countenance is therefore generally pale.

Having thus explained how the cerebral and spinal systems, are affected in Hydrophobia, it could scarcely be imagined that the ganglionic system, being thus formidably attacked, on both sides, could remain long undisturbed. Liquids which are so essentially necessary to the due performance of the functions, of the ganglionic viscera, are prevented from descending into the stomach, by the difficulty of deglutition. Even should a fluid arrive at the stomach, it is often immediately rejected by vomiting, owing to the energy of the vocal nerve being destroyed, and thus leaving the organic irritability of this viscus unrestrained. Thirst, therefore, must become urgent, with all its train of dreadful symptoms. This is still farther increased by the effect of fear upon the cerebral system, which I have seen in this disease, excite a frequent desire to pass urine.

When the functions of the lungs are interrupted, the sanguiferous circulation, must soon participate in the injury. **Bichat** has shewn, that blood, which has not undergone the necessary changes in the lungs, is still capable of exciting the contraction of the heart, when it has been thrown into the aortic ventricle. This blood is then sent up to the brain, where it circulates, instead of the arterial. It has been proved, by the author just mentioned, that the venous blood, induces its sedative effects only at the extremity of the arterial system, and not by its contact, with the internal surface of the heart. The heart therefore, cannot be affected so as to destroy its activity, until the black blood operates by its contact, with the fleshy fibres of the substance of the heart.

This viscus, which is the center of the ganglionic system, having its activity thus gradually destroyed; the whole of the ganglionic viscera soon shares its fate, and general death speedily puts a period to the conflict.

SECT. II.

Morbid Appearances after Death.

From what has been observed with respect to the nature of Hydrophobia, it could hardly be expected, that any thing like the morbid appearances which have been seen to occur in Tetanus, would take place in this disease. As it has been proved, that the spinal system is affected, by the morbid poison destroying its energy: the only change that can be expected to occur in the nervous mass of the spine, is, that its texture should appear of a deeper colour and more firm than natural. This is owing to the delicate structure of this system being rendered by the poison, incapable of resisting the accumulation of blood, before the force of the heart and arteries has been weakened. Many instances of which have been recorded. It has been also noticed, that the medullary structure of the brain, has frequently been found to have suffered a similar alteration.

The dryness, which is often so remarkable in various parts of the body, where the person has been cut off by Hydrophobia, may be considerably increased, by the almost total privation of fluid, while the secretions are in general performed without interruption, particularly in the commencement of the disease. When Hydrophobia, hastens rapidly to a fatal termination, little other organic destruction can be discovered.

When the course of the disease, has been retarded by any accidental circumstance, even for one day, morbid appearances may take place, in various parts, all however, bearing the same characteristic marks.

It was observed, when describing the symptoms of Hydrophobia, that the blood was accumulated on the internal organs. The tone of these parts being destroyed by the disease, it cannot be surprising that extravasation may be seen in several places after death. These appearances can however, only be the effects of the disease, as they are not often met with, and are not always in similar situations. MORGANI has given some dissections of the disease, where several spots of dark coloured blood were seen effused in the brain, in others water has been found in the ventricles. The lining membrane of the œsophagus is very generally found to have its vessels distended with dark blood, sometimes even abrasions may be discovered. But there never has been seen any thing like a purulent formation here, or indeed in any part of the body, of a person who died of this disease. The coats of the stomach, have frequently exhibited marks of increased vascularity, often approaching to gangrene, and a similar effect of the disease is sometimes observable in the liver.

When the structure of an organ, essential to life, has not been destroyed, by the disease, or the remedies employed for its relief; the immediate cause of death in Hydrophobia, appears to arise from the organic irritability being suppressed. This is accomplished by the blood, which has not undergone the necessary changes in the lungs, coming in contact with the fibres at the extremities of the arterial system, and thus destroying the vital action of the part.

SECT. III.

Causes.

WITH respect to the Cause of Hydrophobia, in the human subject, it must be evident, from what has been already said, that it is a morbid poison, acting upon the nervous system of the Spine, and there producing a sedative effect. Although the disease is generally found to arise from the communication of a morbid poison from some animal, yet, any cause, which can induce a similar effect upon the nervous system of the Spine, must produce true Hydrophobia. Thus some mineral poisons can induce the disease. A case of this kind occurred, a few years ago, in the Westmoreland Lock Hospital. It was that of a young woman, who had been using mercury for the cure of Syphilis, and, as happens in some rare cases, the remedy became a poison to her constitution, peculiar circumstances directed its effects upon the spinal system, and Hydrophobia was the consequence. She died on the fourth day from the first appearance of difficult deglutition, on dissection however, not the slightest morbid appearance could be discovered. The cavity of the Spine, however was not examined. VERDRIES in his treatise on Hydrophobia, says the disease has occured in a patient, after using mercury, without having been previously bitten by a rabid animal, and HOFFMAN, has observed, that when mercury has not produced salivation, "facile fit, ut perennante nihilo secius affluxu "illi succi copiosius ad spinalis medullæ "principia, ipsosque nervos ruant, ibidemque "stagnando ac comprimendo influxum nervei "fluidi, in nervos remorentur."

That mercury sometimes acts as a poison of this kind, must be known to every practitioner. But it is a curious circumstance, that it appears to be capable of affecting one system only, at a time. Thus it sometimes affects the cerebral system and there gives rise to insanity. The erethismus, which is so accurately described by MR. PEARSON, is the consequence of its operation on the ganglionic system, which would be sufficiently manifest by a moment's consideration of the attending symptoms.

When a quantity of berries of the deadly nightshade have been taken into the stomach, scarcely half an hour elapses before violent symptoms supervene, viz. vertigo, delirium, great thirst, painful degultition, and retching; the pulse is small, hard, quick and subsultus tendinum, risus sardonicus, and coma, generally precede death. The body being opened, inflammation has been discovered in the intestines, mescentery, and liver. BOULDAC (in the academy of sciences of Paris) found the stomach of a child erodedin three places. Here then are effects of a vegetable poison, extremely analogous, both in symptoms and appearances after death, to Hydrophobia.

When the poison of Hydrophobia, has been communicated to the human species, by the bite of an animal; it appears like the infection of small-pox, secundary in its operation. It lies concealed, until by an assimilatory process, it takes on a nature capable of affecting the human frame. Although the infection is generally conveyed to the system, by means of a bite, yet several instances of this disease, having been caused by the saliva of a rabid animal, where no wound had been inflicted, may be seen in DR. HAMILTON'S, treatise on this disease.

There is an important circumstance with respect to the animals, which are capable of communicating the disease, by the bite. In animals of the dog and cat kind, the skin is not endowed with the capability of throwing off the perspiration. In the dog, nature has provided for the defect, by directing the whole of this operation, to the tongue and salivary glands. There is no disease to which the animal frame is liable, which has not some effect upon the perspiration. In many diseases, which occur in the human subject, this secretion has been so vitiated, that it has infected any scratch or pimple on the hands of the attendant.

From all I have been able to ascertain, with respect to the predisposing causes of Hydrophobia, in the dog, I find them perfectly analogous to the causes of putrid fever, in the human subject. I am therefore disposed to believe, that putrid fever gives origin to the disease in animals, which do not perspire by the skin. By obviating the causes of fever where dogs are kept, it would considerably diminish the chances of this disease, occurring amongst them.

SECT. IV.

Prevention after Bite.

Since this terrible distemper first attracted the notice of the practitioners, a variety of methods of treating the wound, which has been made by the rabid animal, have been recommended. As it would be almost endless to enumerate them here, I shall mention those only which give some probability of success. The first that would naturally be imagined, is instant excision of every atom, that could possibly come in contact with the teeth or saliva of the rabid animal. But this is by no means even generally practicable. The same objection is applicable to the actual cautery, which is always worse than useless. The method therefore that I would recommend, where it is possible to apply it instantly, would be to pour boiling water into the wound. This has two important advantages, the one is by diluting the poison it may wash it away: the next is by being capable of following all the inlets of the wound, it may excite the most general inflammation of its entire surface. Where this cannot be obtained immediately, cold water may be substituted, and the wound completely washed for a considerable time. Then the wound should be filled with the powder of Peruvian Bark, and a common poultice applied over the whole. The use of the Bark will be explained, when speaking of the treatment of the disease.

SECT. V.

Diagnosis.

The Diagnosis of Hydrophobia, has been generally founded on the difficulty of deglutition, which is so remarkable in this disease. This circumstance has given rise to many mistakes, as this symptom is by no means uncommon in a variety of disorders, particularly those attended with Hysteria. It appears however, from what has been said when describing the symptoms of Hydrophobia, that a Rotatory motion of the head accompanying a difficulty of swallowing liquids, will ever distinguish this disease from all others.

Indeed, should these symptoms occur in any affection, the whole should be treated as genuine Hydrophobia; as it is then evident that the function of the spinal system is defective.

SECT. VI.

Prognosis.

In Hydrophobia, the Prognosis has hitherto been most unfavourable. Indeed when fully establised, Dr. Hammilton says, the disease has, in no instance, admitted of a cure. Fortunately, man does not seem so liable to receive the contagion, as animals of the dog and cat kind. The average number, of those of the human species who have been bitten, and thence received the contagion, is only one in sixteen. Dr. Hammilton, mentions an instance where four men and twelve dogs were bit by the same animal; the men escaped, and the dogs all went mad.

SECT. VII.

Treatment.

From the period when Hydrophobia, first attracted the notice of mankind, an immence variety of nostrums have been brought forward for the cure of this disease.

It appears that animal poisons, in general, require some time to be assimilated, when communicated to an animal of a species different from that in which it originated; before it can produce its peculiar effects. This is remarkably the fact, with respect to the poison of Hydrophobia, as a considerable time generally intervenes before the disease becomes developed, when the infection is conveyed from a rabid animal, to the human species. It has already been stated, that man is not so liable to this disease, as animals of the canine or feline species. This circumstance may in some measure account for the ephemeral celebrity of innumerable remedies for Hydrophobia, which may be met with in medical histories. I have already stated the most simple and what would appear from the very circumstances of the case, the most efficacious and practicable mode of preventing the disease, I will therefore, refer to writers on this subject for farther information respecting them. My object here is, to ascertain what treatment should be adopted when the disease, has actually made its appearance.

Before it had been known that poisons could affect the animal frame, by their operation upon the nerves, without entering the circulation or mass of blood, many remedies were proposed for the cure of Hydrophobia, which were intended to correct the effects of the poison in the blood, or to evacuate it by some emunctory. This idea led to the employment of mercury so as to induce salivaton, and the greater confidence was placed in this medicine, as it was imagined that the disease itself had a natural tendency to be carried off by the salivary discharge. Practitioners therefore tried all means to produce a salivation, in patients afflicted with Hydrophobia, and carried the employment of mercury to such an extent, that the remedy became almost worse than the disease. SAUVAGES mentions his having witnessed six cases of this kind, where the fatal termination had been induced by the mercury itself. As the employment of this medicine was adopted upon mistaken ideas, respecting the nature of the disease, it cannot be surprising that mercury should never have succeeded in curing it, when fully developed. There is, however, another very important circumstance with respect to this remedy; it was stated when treating of the causes of this terrible distemper, that mercury itself, in some rare cases, had induced the disease. When the infection of Hydrophobia, has been communicated by a wound, it is obvious, that by using mercury, the chances of the disease occurring would be nearly doubled. I would not hesitate therefore to conclude, that the employment of mercury is totally inadmissible.*

The inordinate actions which occur in this disase, have led to the employment of opium. This medicine, by its sedative effects, may seem to alleviate some symptoms of this dreadful malady; for it has been found, by experiment, that it is capable of suppressing the organic irritability of the muscular parts. It also, however, affects the different nervous systems, at the same time, by destroying their energy. As therefore, opium, in some degree coincides in its action with the morbid poison, the principal effect that might be expected from it, when given in Hydrophobia, would be to lessen, in some measure, the violence of the convulsive spasms, and hasten on the fatal termination. When opium is taken into the stomach, besides this general effect, it destroys the local irritability of that organ, and thus allows mortification to take place, which frequently cuts off the patient, before the natural course of the disease would put a period to his existence. Mortification in the stomach and neighbouring parts, is, therefore, generally met with on dessection of those who were given opium to any extent, during the treatment of the disease.

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* Instances of the inefficacy of this medicine, even as a preventative of Hydrophobia, may be seen in the Encyclopedia Britannica, article "Medicine," and Daniel's Rural Sports.

Blood-letting has frequently been employed, as a remedy ; but in no one instance is it asserted to have been attended with any advantage. As the disease is not seated in the blood, this operation could not diminish the quantity or force of the poison. When animals are killed by the loss of blood, it is known that the most violent convulsive spasms always occur for some time before life is totally extinct.

Any person who has witnessed the effects of this remedy, in Hydrophobia, must remember that the convulsive affections always increased in proportion as the quantity of blood was abstracted. The reason of this must be obvious from what has been already said. It is evident, that venesection should never be employed, in the treatment of this disease.

I have thus slightly noticed these remedies, as it usually happens that the cure is confined almost entirely to the operation of some one of them, as being the most active and powerful within the reach of the practitioner. It may be clearly understood, from what has been said respecting the nature of this disease, that although the operation of the poison is to destroy the energy of the spinal system; yet that general death is induced by the influence of this circumstance upon the other systems. This circumstance appears sufficient to account for no single remedy being efficacious in Hydrophobia.

Prior to entering into an investigation of the remedies, proper to be employed in the treatment of Hydrophobia, it may be of importance to attend to some circumstances which occur in affections of this kind.

It has been mentioned that the injury of the spinal canal, by the cause of Hydrophobia, is not the immediate cause of death. It is also a curious law in the animal economy, that a poison which affects any part of the frame, will become innoxious, after acting on it, for a certain time, which is longer or shorter, according to its individual nature. Thus the morbid matter of Small-pox produces certain effects in the body, and then ceases to excite any disturbance. Many other diseases are known to act in a similar manner, and if no vital part has been materially injured, the disease will run its course, and the patient recover. The same circumstances may be observed even in vegitable poisons. Thus the essential oil of bitter Almonds will act upon the cerebral and spinal systems, and immediately destroy their functions, so as to render the animal totally insensible, and deprive him of the power of muscular action. General death would therefore very speedily take place. But if the respiration be artificially kept up, the action of the heart will continue free, by which means the functions of the ganglionic system will be preserved, from a participation in the threatened destruction. Life will thus be supported until the poison has exhausted its powers against the other systems, and the animal will, in a short time, regain the full enjoyment of all its functions, as if they had received no injury whatever. This fact has never been taken into consideration in the treatment of Hydrophobia, and therefore the disease when fully formed, has hitherto been always mortal.

The treatment of this disease must be directed, at the same time, to the three systems. As the primary effect of the poison, from whatever source, is sedative against the nervous system of the spine, the first object should be to support the energy of this system, by appropriate medicines. As all diseases of the spinal system have an intermittent type, or consist of intermissions and exacerbations ; the known efficacy of Peruvian bark in Agues, would lead to the employment of it in this case. Dr. MARSHAL has given the case of THOMAS PEARSON, œt. 14, in whom the Bark seems to have had considerable influence upon the disease.

When Hydrophobia has been caused by the bite of a rabid animal, a pain and some change usually occurs in the wound, before the general symptoms become apparent. If bark had any power of resisting the sedative effects of the poison, it ought to have some influence, when applied at the very origin of the disease. Some advantage may therefore be expected from the application of Peruvian bark in powder, to the wound, after having removed as much as may be practicable by excision. This ought to be done, even though the wound may be apparently already healed.*

* I have had an apportunity of treating four cases in this manner; they were all bites from dogs supposed to be mad, but in none of them did Hydrophobia supervene. One of these patients who lives at a village about three miles from town, was bit by a strange dog in the leg. I saw him about a fortnight after the accident, the

In all diseases to which the human frame is liable, the different organs which are not capable of resisting the effects of the morbid changes, which take place in the functions of the nervous system, where the disease is seated, soon yield to the attack. As each system falls into the morbid state, the disease accumulates strength, and thus quickly causes general destruction. The rapidity with which Hydrophobia carries destruction through the functions of the animal frame, renders it necessary to afford instant support to the two systems, which are at first exempt from its effects. In the history of this disease, it was stated, that the most formidable attack upon the cerebral system, arose from the transmission of blood through the brain, which had not undergone the necessary changes in the lungs.

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wound appeared quite sloughing; there was great anxiety expressed in his countenance; his sleep was very much disturbed, and he was affected with a considerable degree of general fever. I directed that the wound should be dressed with the powder of Peruvian bark, over which a poultice should be applied. I also ordered him a mixture of the water of acetite of ammonia, under which treatment he perfectly recovered.

Pneumatic chemistry fortunately affords a method, by which this circumstance can be completely obviated Oxigen gas can easily be procured, and by a convenient apparatus, the patient may inhale a quantity of it, several times in the course of the day; until the disease subsides. The effect of this remedy under similar circumstances I had an opportunity of observing last year, in a case of Angina Pectoris, where the fatal period was decidedly put off for three months, by the patient inhaling a quantity of pure oxigen gas, every night on going to bed.* By means of this the brain obtains sufficient energy, to resist the effects of the disease.

This remedy at the same time also supports the organic irritability of the heart, upon which the functions of the ganglionic system in a great measure depend.

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* I had the honour of reading a statement of this case, a short time ago, before the association of the members of the College of Physicians, in Dublin.

It has been observed in a former part of this treatise, that when the functions of the spinal system have been destroyed, the extreme vessels become incapable of resisting the vis a tergo, and that inflammation and mortification were the natural consequences. By supplying the blood, therefore with the necessary stimulus to vitality, the force of the heart would be increased, and thus give a greater tendency to mortification. As it is necessary to supply the brain with well formed arterial blood, thereby to enable that system to resist the sedative effects of the disease; the same assistance is also required by the ganglionic system. It is necessary, on this account, that the force of the heart and arteries should be diminished, while the organs of the ganglionic system, are at the same time, supplied with blood which has undergone the necessary changes in the lungs.

When asetous acid has been taken into the tomach in small quantities, for a considerable time, the individual becomes emaciated, and a general paleness spreads over the surface of his body. The inhabitants of some inland counties of England have a curious mode of prize fighting: two men agree for a wager to strike their uncovered heads with sticks, and the first that draws blood from the other, is declared the winner. It is often wonderful what a number of blows they receive which break the skin, and yet not one drop of blood escapes. The manner they accomplish this is by drinking quantities of vinegar, for several weeks, previous to the engagement. This effect seems to be peculiar to the acetous acid, which appears to act thus, by accumulating the blood in the venous apparatus.*

In Hydrophobia the accumulation of blood in the venous apparatus, is attended with considerable advantages. By means of this, the quantity and force of the blood, that is impelled against the organs, which are weakened by the disease, is very much lessened : while at the same time the powers of the sanguiferous apparatus to resist the disease, are preserved entire; not having been diminished by the operation of blood-letting.

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* Digitalis and the acetous acid are two medicines which have very powerful effects, in diminishing the force of the sanguiferous circulation. As a remedy of this kind appeared necessary in the treatment of Hydropbobia, I was anxious to determine which of these would be preferable. I therefore made some experiments to ascertain this circumstance, and am led to believe that digitalis acts upon the arterial apparatus, and by diminishing the tone of

The acetous acid should therefore be given in repeated doses, at short intervals, until the patient is secure from the disease. Numerous cases of Hydrophobia have lately occurred on the continent, which are said to have been cured by this remedy alone.

I have thus endeavoured to explain the nature and treatment of two diseases, incidental

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the vessels, allows the blood to accumulate in the arteries. In the living animal, this is indicated by the increased calibre of the arteries, and softness and intermission of the pulse. The acetous acid, on the contrary, appeared to cause the accumulation of blood, to take place in the venous apparatus, and in the living animal is indicated by the smallness of the pulse and general emaciation.

to the spinal system. The one consisting in the extreme of increased action, the other being extreme diminished action. It is obvious that a variety of modifications may occur between these extremes of disease. To many of these, nosoligists have given distinct appellations. The treatment, however, in all must be founded upon the foregoing principles, according to the judgment of the practitioner, in each individual case.

APPENDIX.

THE following case occurred last week, in the Regimental hospital of the Rifle Brigade. The examination of this patient, after death, was perfectly consistent with the principles, respecting the nature and treatment of Tetanus, which I have laid down in this treatise.

A soldier of the Rifle Brigade, aged 25, of a strong muscular habit, had been doing duty, for a short time, at the Pigeon-house, where he was frequently exposed to a cold easterly wind, blowing from the sea. On Friday, 25th of April, he found himself ill, and had a severe fit of shivering, which induced him to return to head quarters, at the royal barracks. In the evening he drank pretty freely, of spirits or porter, and finding his complaint still increase, he was conveyed to the hospital.

On his admission, he was affected with œdematous swellings of the lower extremities, and had apparently a general tendency to anasarca, accompanied with frequent severe vomiting and constipation. Two days after his admission, he became affected with violent convulsive spasms of the muscles, recurring at short intervals. Notwithstanding the remedies employed, these convulsive spasms gradually increased, and he expired on Friday, the 2nd of May. A few days previous to his death, his breathing was considerably affected, and he could perform only four short respirations in a minute. The functions of the brain were also very much disturbed, for one or two days before he expired. The blood which was profusely drawn, during the course of the disease, was deeply cupped, and contained but a very small portion of the colouring matter.

Mr. Ridgeway, and Dr. M'Cabe (the medical gentlemen of the regiment,) kindly permitted me to be present at the examination of the body after death. Mr. Ribton also assisted at the dissection, (who is now studying medicine, and whose indefatigable zeal and attention, must insure his success.

The examination took place on Saturday, the 3d of May, the day after the patient died.

The muscles were completely rigid, and gave that sensation even through the integuments, which is peculiar in Tetanus.* On opening the abdomen, the intestines appeared paler than natural. In the thorax the muscular structure of the heart appeared remarkably pale. The brain was extremely firm, and a considerable quantity of water was found in the ventricles, and the plexus choroides was observed to be extremely pale. On dissecting the muscles from the back, for the purpose of opening the cavity of the spine, they appeared of a deep florid colour, and their fibers so distinct and rigid, that to break even a single fassiculus, required considerable force.

On carefully sawing the vertebræ, so as to lay bare the nervous mass of the spine, a great quantity of water was found between the vaginal ligament and the dura mater. A considerable quantity appeared also distending the latter membrane, as the fluid was contained between it and the pia mater. On raising the nervous mass, with its investing membranes, from the bodies of the vertebræ, there appeared some vestiges of inflammatory action about the upper dorsal vertebræ; but on turning down the muscles and integuments which covered this part, it was found that a blister had been applied between the shoulders. Between the dura mater, however, and the bodies of the lumbar vertebræ there was discovered a considerable effusion of watery blood into the cellular substance, which was exactly similar to what I have before represented to occur in cases of this nature. In this case there was also a considerable quantity of air contained in the vessels and cellular substance, along the whole length of the spinal canal.

There are many circumstances, worthy of attention in this case. The difference of the ganglionic system from that of the spinal was well marked, by the influence of the disease, not extending in a similar manner, to the muscular organs of both systems. This was marked by the muscular parts of the heart and intestines being paler than natural, while the muscular organs belonging to the spinal system were remarkably florid and rigid.—Another most important circumstance was, the effect of the blister, which had been judiciously applied between the shoulders: the power of which was so conspicuous in lessening the effusion which usually takes place in this disease, between the spinal membranes immediately under that part; the effusion being in full force at the other extremity of the canal where the blister had not been applied. The appearance of the blood which had been drawn in this case, was quite consistent with the influence which I have mentioned, the spinal system exercises in the animal economy, as the increased action of this system, caused an increased deposition from the blood, which was rendered conspicuous by the defect of the coloring matter in this fluid.

FINIS